

**A critical appraisal of “A School-Based Injury Prevention Program  
to Reduce Sport Injury Risk and Improve Healthy Outcomes in  
Youth: A Pilot Cluster-Randomized Controlled Trial”**

**By**

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## **Abstract**

**Introduction:** With an evidence-based approach in medicine, one must utilize critical analysis of scientific literature to effectively determine its potential application. This critical appraisal focuses on a specific article concerning neuromuscular training and its effectiveness in answering a clinical question concerning the prevention of knee injuries among youth. In order to better determine the article's applicability, it was carefully analyzed based on its introduction, methods, results, discussion, and overall study design.

**Methods:** A systematic approach was used during the literature search process in order to arrive at a clinically relevant article for appraisal. This approach included utilizing two internet databases along with specific search criteria to obtain relevant, modern, and academically acceptable articles. This particular article was selected for appraisal due to its overall aim and clinical relevance to the clinical question being investigated.

**Results:** Systematic critical appraisal of the various sections within the article enabled the identification of various strengths and weaknesses found within the study design and article. Division of the appraisal by the article's introduction, methods, results, and discussion allowed more specific criticism of the different areas of the study to aid in determining its overall reliability and potential application. The appraisal effectively identified many areas of improvement for current and future studies, but it also aided in determining strengths found primarily within the design of the study and participation of subjects.

**Discussion:** Following critical appraisal of the article's various sections, the overall clinical significance and application to the clinical question was discussed. Despite the strengths in the design of the study, the large quantity of participants, and the apparent success of the intervention, there was enough weakness found within the study to not be able to directly apply

this intervention in a clinical setting. However, the authors formulated an acceptable study that can be used in further research in an increasingly popular training and rehabilitation approach.

**Key words**

“neuromuscular”, “injury”, “youth”, “prevention”, “strength”

## **Introduction**

The purpose of the critical appraisal of this article is to assess the credibility, reliability, and importance of all components of the study. By analyzing the article, it can be better determined effective or ineffective for application toward a clinical issue or question. In order to determine this, the article was thoroughly analyzed by individually critiquing its introduction, methods, results, and discussion. For this article, critical assessment was performed to determine its potential utilization as a source in evaluating whether neuromuscular exercises are more effective than strength training for preventing the occurrence of knee injuries in youth athletes.

## **Methods**

When performing a literature search to find sources related to my clinical question two databases were utilized, PubMed and ASU U-Search. The following keywords were used in different combinations during the search: prevention, youth, injury, neuromuscular, and strength. In order to better refine the results from the search, certain limitations were placed on the search. These limitations included a publication date range of 2012-2017 to obtain more recent articles that would hopefully contain more updated and effective information. Only full text and peer-reviewed articles were viewed so that only articles that had been through the peer review process and that could be fully analyzed were available. Finally, search results were narrowed down to only English-based articles to restrict the number of results that could not be used. No specific inclusion or exclusion criteria were included during my search other than a requirement that the participants be considered “youth”. After approximately 10-15 relevant sources were obtained, the results were then reviewed for content.

The study that was selected for this appraisal was conducted in Canada by Dr. Sarah Richmond, Dr. Jian Kang, Dr. Patricia Doyle-Baker, Dr. Alberto Nettel-Aguirre, and Dr. Carolyn Emery. The article was published in the Clinical Journal of Sports Medicine in 2016. This article was

chosen for critical appraisal from the three options because it was determined to be the most credible and relevant in relation to my clinical question. While it was difficult to blind the participants from which type of training they were receiving, the study was set up in a way that involved a third party randomly assigning the participants into intervention and control groups. Another strength of this study is that schools from equivalent socioeconomic areas were used and students were excluded who had medical conditions or a history of musculoskeletal disorders. As previously stated, participants were not directly instructed whether they were in the intervention or control group, but it is unlikely that that subjects were truly blinded to their group assignment which may have impacted their behavior and performance. The outcome was dependent on the participant's reporting of an injury who was then assessed by a physiotherapist who was likely competent enough in injury assessment for the purpose of this study, but it was not stated whether the outcome assessor was aware of the participants' group assignments. The investigators established the experiment in a way that minimized variables for the two groups aside from the experimental interventions. Another strength of this study utilizing school implementation is that the investigators were able to collect data for the duration needed and not experience subject attrition.

## **Results**

### Summary of the study

This study examined the impact that implementing a high-intensity neuromuscular training program into school physical education would have in reducing sport injury risk. In order to test this, middle school students in two different schools were randomly assigned to either an intervention group who took part in the high-intensity neuromuscular training program or the control group who took part in a low-intensity aerobic and stretching based program. Outcome

measures focused on recording the incidence of injuries to determine the effect of the respective training program for each trial group. The study reported a decreased number of injuries in the intervention group in comparison to the control group, giving support to the hypothesis that neuromuscular training is effective in reducing the risk of sport-related injury, among other positive results.

#### Appraisal of the study introduction

There are several strengths to the introduction of this article. The authors chose to be very concise with the presented information and did not include excessive or unimportant information. They also included all of the critical variables of the study, such as the high-intensity neuromuscular injury prevention program, incidence of sport-related injuries, aerobic fitness, and anthropometry. Furthermore, the authors supported their statements within the introduction by using literature to form solid rationale behind the study.

Despite these strengths, there are several weaknesses to the introduction portion of this article.

While the article did not include excessive or irrelevant information, there is room for elaboration on the mentioned variables as well as the intervention itself. More comprehensive background information about the variables would have greatly strengthened the introduction and the article as a whole. Another weakness of the introduction is found within the literature utilized by the authors. A large amount of the sources cited within the introduction are either not from primary sources of credible journals or are not very modern in terms of their publication date.

#### Appraisal of the study methods

There are multiple strengths to the methods portion of the study. These range from the design of the study to the participants themselves. The double-blind nature of the design greatly diminishes

the chance at bias impacting the strength of the study. Furthermore, the researchers investigated the impact of the intervention over a period of time long enough to observe change between the control and intervention groups. Another important strength of the study is the large sample size coupled with little attrition due to the utilization of school systems as the source of subjects. This approach enabled the researchers to implement this study across two similar groups of large quantities, deliver the exercise programs to the two groups with little variability, and experience little to no dropout by the participants. Finally, another positive aspect of the study is that the intervention, differences of treatment of the two groups, and outcomes measures were thoroughly explained and would be replicable in future studies.

There were also a few negatives found within the methods, such as the students who did not take part in the study, the lack of validity of certain outcomes measures, and the lack of explanation of the control group exercise program. While there was a large number of subjects and little attrition, there was a significant number of students who did not consent to take part in the study from the beginning. This may impact the study in terms of poor representation of the entire population. There is also concern about some of the outcome measures because of their poor relation to certain variables, such as those aimed at measuring body fat, and the measurement of injury incidence due to its subjective nature.

#### Appraisal of the study results

The study results were presented in a clear and efficient manner. All of outcomes measures that were presented and explained in the methods section of the article were reported in the results despite a slight change in order. These results addressed all three components of the study that were introduced earlier in the article. Finally, the researchers effectively used a statistically significant  $p$  value less than 0.05 as well as a confidence interval of 95%.

There were few weaknesses to the results section of the article aside from the absence of a figure to portray the results from the changes in aerobic fitness and waist circumference measures.

#### Appraisal of the study discussion

Within the discussion section of the article, the authors did well in not simply restating results that were discussed in the previous section. They effectively discussed the findings concerning improvements in aerobic fitness and apparent reduction in body fat increases. Furthermore, the authors explained reasonable limitations to the study and supported their statements with primarily reliable and modern literature. Discussion about the limitations and areas of improvement for the study identifies possible drawbacks with their study design, but it also helps establish a more solid foundation for future similar studies.

Despite the authors' effective discussion of several components of the study and identification of limitations, there is substantial room for improvement in discussion of the primary aim of the study, injury incidence. The lack of elaboration on this area of the study weakens this section of the article and may impact the conclusion made by the authors concerning the effectiveness of the intervention of preventing injury occurrence. Another area of weakness found within the results is that they did not address the clinical significance or application of the study.

#### **Discussion**

This study has some clinical significance because of the reduction in sport injuries as a result of the integration of neuromuscular exercises. While the findings of this study do not directly answer the clinical question, they give support to the effectiveness of neuromuscular training in reducing injury risk in a youth population. A more appropriate study for the clinical question would directly compare neuromuscular training with solely strength training and its impact on injury prevention in the knee. However, this experiment is a valuable supplemental resource in



the process of researching the clinical question. Another aspect of this study that must be considered is that the intervention of neuromuscular training was focused on the entire body. With the clinical question focusing on the knee, more specific neuromuscular training would likely be utilized to target tissues that directly impact the integrity of the knee.

When evaluating the potential of implementing the study's intervention into a clinical setting, it must be appraised in terms of both its effectiveness and applicability. Potential benefits of using this intervention is its replicability as well as its simplicity and effectiveness. The intervention was instructed by trained professionals initially, but then it was able to be carried about by the physical education teachers as well as the students themselves. This makes the exercise protocol something that can be learned quickly and effectively and be utilized in a home setting by the patient. There are few direct risks in using the intervention itself, but there are some potential limitations to its application in a clinical setting. First, the intervention protocol was limited in its duration to be able to be used in the school setting. It is likely that a longer duration program would need to be implemented. Furthermore, the intervention used in the study focused on whole body neuromuscular training. For many clinical situations, a program focusing on a specific area of the body is more likely to be utilized. Regardless of this, the benefits of using the intervention clinically appear to outweigh the little to no risks associated with it.

It has been shown that using neuromuscular training is effective in reducing and preventing injury incidence. In regard to using this specific intervention in the clinic, it would be dependent on the patient and reason for treatment. It is unlikely that there is enough evidence of effectiveness from this study alone to implement the specified treatment protocol to a future client or patient. In order to truly consider this evidence strong enough, a more specified protocol would need to be tested as well as more valid outcome measurement tools to assess injury

incidence. Despite this, one positive aspect of using the intervention in its current state is that it would not require a large amount of knowledge, skills, or resources in order to implement it into a clinical setting.

All in all, there were a variety of strengths and weaknesses for all of the components of this article and study. The authors formulated a clear hypothesis and did well in the organization and presentation of the methods and results. However, there is much room for improvement in regard to the authors' explanation of how the intervention should impact injury prevention and the overall discussion of results. There appears to be insufficient evidence and direct applicability to strongly consider using the intervention clinically.